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# Sighting of the rare jellyfish *Anomalorhiza shawi* Light, 1921 in a marine protected area of Hong Kong

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**Abstract**

*Anomalorhiza shawi* Light, 1921 is a species of rhizostome jellyfish (Cnidaria, Rhizostomeae), which is the most diverse order of scyphozoan jellyfishes. This species has rarely been observed, such that little information exists on its distribution or biology. We report a new sighting of *A. shawi* in the Hoi Ha Wan Marine Park of Hong Kong, which extends this species' geographic distribution by 1,116 km northwards from Manila Bay, Philippines. We also highlight the value of community science platforms for species identification and range extension.

**Keywords**

Hoi Ha Wan, live encounter, Rhizostomeae, Scyphozoa, South China Sea

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## Introduction

*Anomalorhiza shawi* Light, 1921 is a rarely observed species of rhizostome jellyfish. This species belongs to the order Rhizostomeae, one of the most diverse orders of scyphozoan jellyfishes containing 11 families, 28 genera, and 89 extant species (Jarms and Morandini 2019), in the class Scyphozoa. Rhizostome jellyfishes can be distinguished from other orders due to the absence of tentacles on the bell margin, as well as having eight oral arms which have suctorial mouths and are fused proximally (Daly et al. 2007).

Very little is known about the biology and ecology of this species due to a lack of observations or records in the scientific literature. The species was initially described by Light in 1921 on the basis of two specimens collected in Manila Bay, Philippines (Light 1921). Additional reports of this species have been published, further extending the known range of the species to Hawaii (Cooke 1984), the east coast of Thailand (Marine and Coastal Research and Development Institute 2015), the Philippines (Kitamura and Omori 2010), and most recently Sabah, Malaysia (Chuan et al. 2020) (Fig. 1). Other observations have been uploaded to various online platforms, such as YouTube and iNaturalist, showcasing the importance of community science for sharing observations of rare and even new species.

Hong Kong is situated in the South China Sea along the southern coast of China, east of the Pearl River, and part of the conservation management measures of the Pearl River Delta. Hong Kong's climate is characterised by two distinct seasons from its monsoonal climate, with a dry season (November–March) and a wet season (May–October). The dry season is accompanied

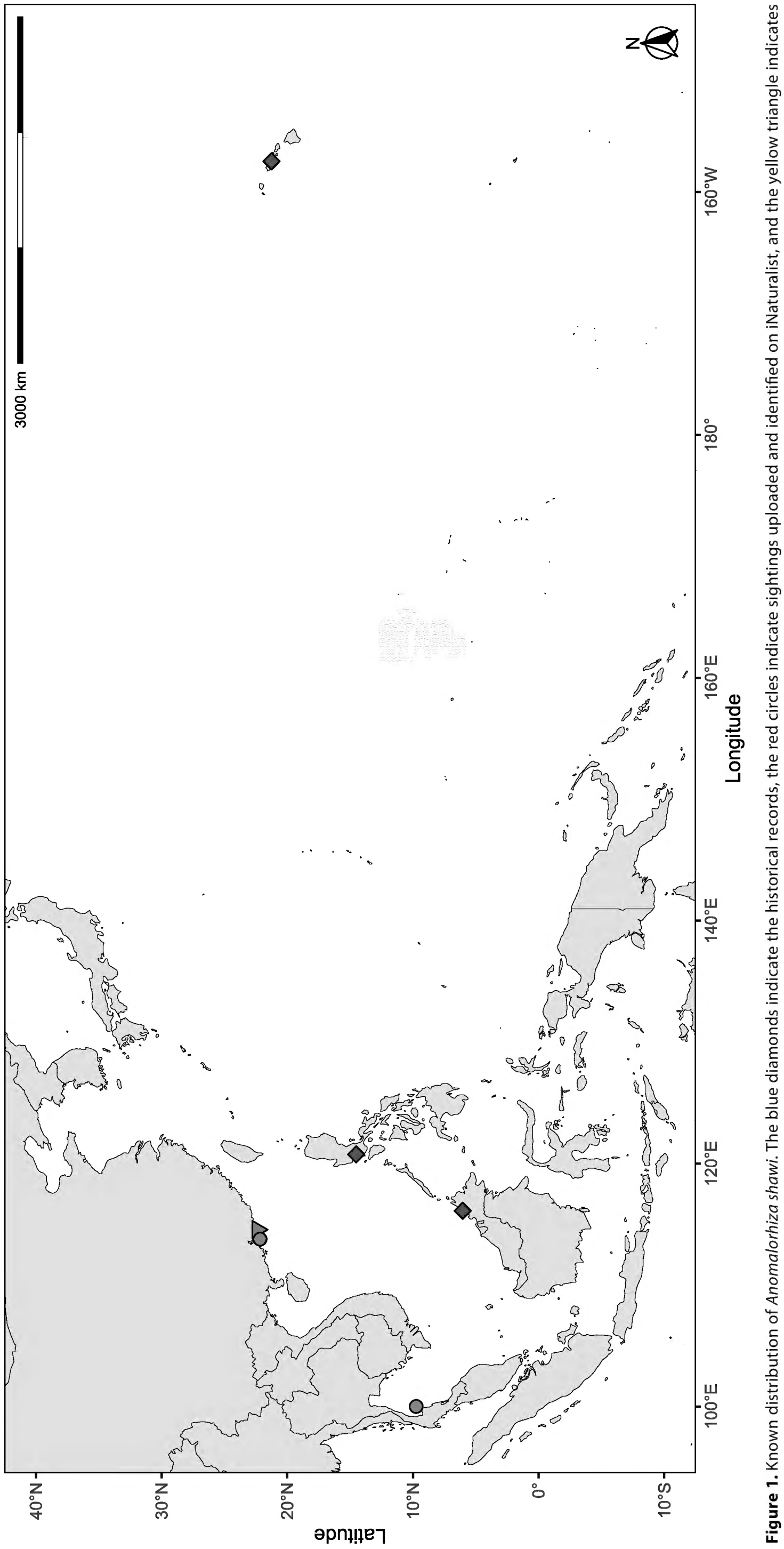


**Figure 1.** Known distribution of *Anomalorhiza shawi*. The blue diamonds indicate the historical records, the red circles indicate sightings uploaded and identified on iNaturalist, and the yellow triangle indicates the new record presented in this study.

by cooler temperatures, with water temperatures ranging between 17 and 21 °C. The seasonal variation in rainfall causes increased river discharge from the Pearl River, which leads to an influx of nutrient-rich water and has triggered documented seasonal algal blooms, with 1,940 documented red tide events in Hong Kong between 1975 and 2020 (AFCD 2020). Yet, very little research and monitoring is currently done on Hong Kong's algal blooms, with only one reporting channel to Hong Kong's Agricultural, Fisheries and Conservation Department (AFCD) and some studies using unmanned aerial vehicles to monitor coastal blooms (Cheng et al. 2020a, 2020b) or using predictive models to forecast blooms (Guo et al. 2020). Additionally, no scientific research exists outlining the relationship between Hong Kong's seasonal variations and the distribution and sightings of jellyfishes, but jellyfish fisheries studies in South East Asian waters have observed that the fishing season is inversely related to the monsoon due to rough seas caused by the northeast and northwest winds (Omori and Nakano 2001). Other studies in the Yellow Sea and the East China Sea on *Nemopilema nomurai* Kishinouye, 1922 (Scyphozoa, Rhizostomeae) indicate that abundance may be affected by the environmental conditions of their strobilation site, including salinity, temperature, and food availability (Xu et al. 2013; Sun et al. 2015; Feng et al. 2018a, 2018b) and that these fluctuations may also be correlated to the oceanic currents in the Yellow Sea and the Japan Sea (Kitajima et al. 2020), both factors which remain specific to those areas.

Despite its small marine area, the waters of Hong Kong are an ecological hotspot of high species richness, with 5,943 marine species recorded (Ng et al. 2016). This biodiversity is partly protected by a series of Marine Protected Areas (MPAs) which cover approximately 2.5% of the Hong Kong waters.

A substantial amount of research has been carried out on the aquatic ecosystems of Hong Kong, but few studies have focused on jellyfishes, even though their presence is recorded online on popular news outlets (e.g., South China Morning Post and Hong Kong Free Press), and on the AFCD website (AFCD 2002). Jellyfish blooms, including species such as *Aurelia* spp., *Cyanea nozakii* Kishinouye, 1891 and *Nemopilema nomurai*, have also been documented to form increasingly frequent and large blooms in Chinese seas, particularly in the East China and Yellow seas (Jiang et al. 2008; Dong et al. 2010). Jellyfishes are also commonly targeted as fisheries for consumption with demand coming from Hong Kong and Japan (Omori and Nakano 2001; Dong et al. 2009; Kitamura and Omori 2010), and more recently in the Western Hemisphere (Brotz et al. 2017). The order Rhizostomeae, due to their large size and rigid bodies, encompasses all edible jellyfish. Other rhizostome jellyfish species, such as *Rhopilema esculentum* Kishinouye, 1891, are highly popular and commercially exploited along the coast of China (Omori and Nakano 2001).

There are very few published studies of jellyfishes in Hong Kong (Lam et al. 2014; Nong et al. 2020). This observation highlighting the new record of *A. shawi* can help further improve the knowledge on the range of this species and encourage new studies that may attempt to describe the biology and ecology of this rare species.

## Methods

**Study site.** Hoi Ha Wan is a small bay located on the north-eastern part of Hong Kong, between Mirs Bay and the mouth of the Tolo harbour (Fig. 2). Hoi Ha Wan Marine Park was established in 1996 as part of the first batch of Hong Kong marine parks covering an area of 260 ha. Hoi Ha Wan Marine Park was established to protect ecologically important and sensitive habitats, including coral communities and mangroves.

Within the Hoi Ha Wan Marine Park is located the Jockey Club HSBC WWF-Hong Kong Hoi Ha Marine Life Centre, an education and research centre established in 2004 by the World Wide Fund for Nature. The centre operates educational visits for schools and public visitors, conducting community science research on plankton biodiversity and oceanographical parameters of the park water with local students. Frequent observations of marine wildlife are recorded from the daily boat trips taken throughout the marine park. While conducting public tours in the Hoi Ha Wan Marine Park (Fig. 2), an *Anomalorhiza shawi* individual was encountered from the glass-bottomed boat. According to the regulations of the marine park, no collection of any materials is permitted within its boundary, such that only a photograph was taken of the individual.

## Results

### *Anomalorhiza shawi* Light, 1921

**New records.** HONG KONG • Hong Kong, Hoi Ha Wan Marine Park; 22°28.19′N, 114°20.07′E; 12 Oct. 2019; 1 specimen, sex undetermined (Fig. 3).

**Identification.** The specimen was approximately 30 cm in diameter, with a milky white bell of which the surface was covered with many irregularly sized, brown warts. The pink gonads were easily visible through the bell. The translucent oral arms were marked with a very distinct, electric blue colour, which branched out throughout the length of the arm (canal system). Compared to other online photos of specimens, the observed individual has wider, more opaque-white arms. The photograph was uploaded to the iNaturalist platform, a community platform for documenting nature observations, where the online community can suggest identifications of species. The species was first identified through the iNaturalist community and then confirmed by using Kitamura and Omori (2010), as well as WoRMS (Collins et al. 2020), Light (1921), and Chuan et al. (2020). The photographs were also compared to other online observations (http://www.kohchangnature.com/

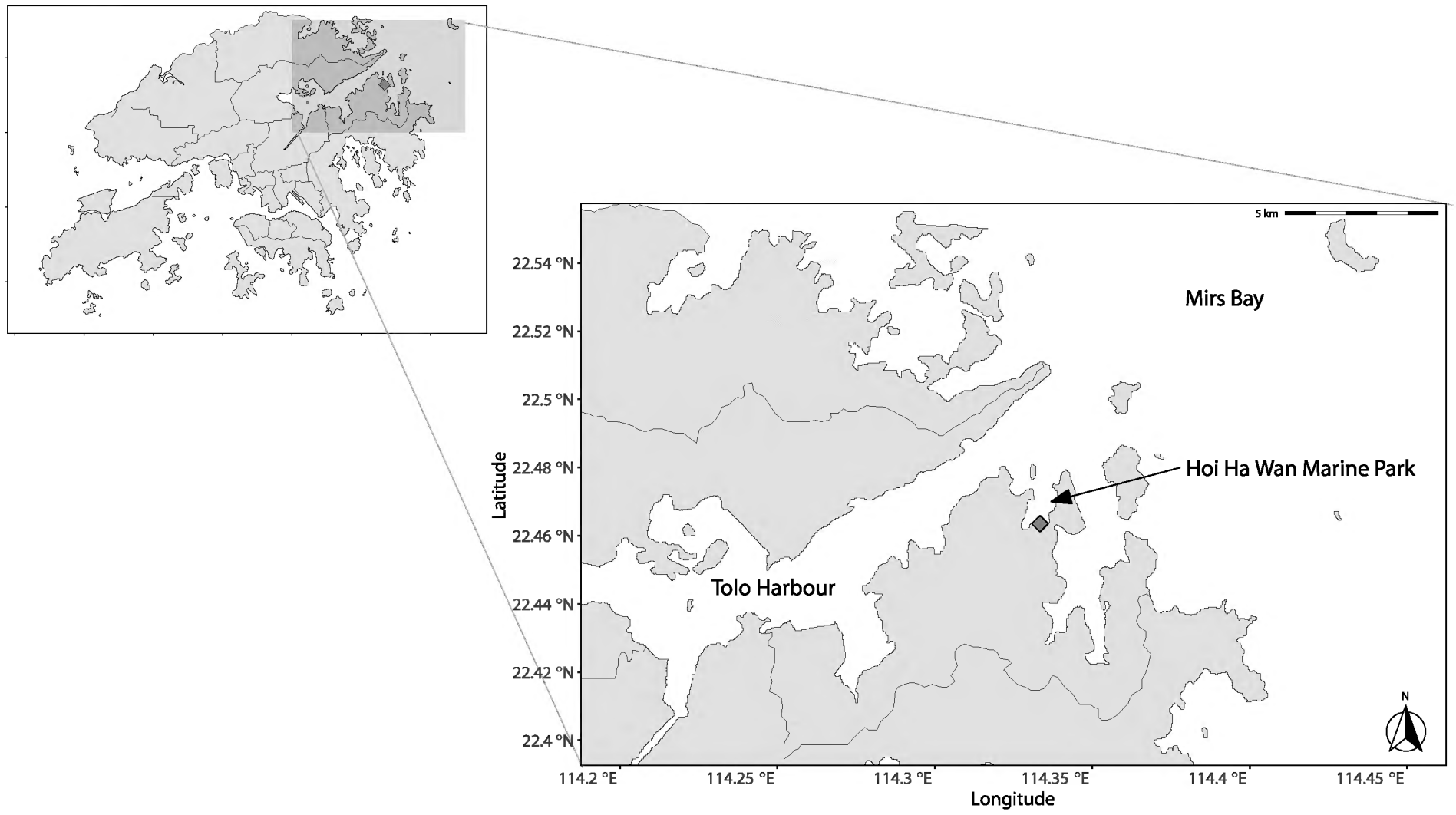


**Figure 2.** Location of the Hoi Ha Wan Marine Park within the Hong Kong Special Administrative Region, where the *Anomalorhiza shawi* individual was sighted. The red diamond indicates the location of the Hoi Ha Marine Life Centre.

category/koh-chang-wildlife/koh-chang-invertebrates/koh-chang-corals/, https://www.chaloklum-diving.com/marine-life-guide-koh-phangan/corals-more-cnidaria/true-jellyfish-scythozoa/other-rhizostome-jellyfish/).

## Discussion

Sightings of *Anomalorhiza shawi* are very rare, with only a handful of published observations (Fig. 1). This brief encounter represents a new sighting record of *A. shawi* in Hong Kong and confirms the presence of *A. shawi* at the furthest point north ever recorded in South East Asian waters. This sighting extends the currently known range of *A. shawi* northwards by 1,116 km from Manila Bay, Philippines (Light 1921). There are four published historical records of sightings of this species (Fig. 1): Philippines (Light 1921), Hawaii (Cooke 1984), Thailand (Marine and Coastal Research and Development Institute 2015), and Malaysia (Chuan et al. 2020). Online searches on social media platforms and iNaturalist shows only two potential prior observations of this species in Hong Kong (Fig. 1) in 2016 and 2020, but these records have not been verified or peer reviewed.

*Anomalorhiza shawi* is known to associate with other marine organisms, with previous records of *A. shawi* showing crabs and juvenile fishes found within the bell of the medusae (Chuan et al. 2020). Small organisms will generally associate with jellyfishes to obtain shelter from predators (Purcell and Arai 2001; Ohtsuka et al. 2010; Gonçalves et al. 2016; Moraes et al. 2017), providing trophic resources and protection for juvenile fish (Masuda et al. 2008; Griffin et al. 2019), as a food source (Pauly et al. 2009; D'Ambra et al. 2014), for prey collection (Masuda et al. 2008), or as a form of transportation. Small crustaceans have also been observed in facultative commensalism with jellyfish (Martinelli Filho et al. 2008). In the observed Hong Kong individual, some small fish were seen around the bell of the jellyfish (Fig. 3A), but none were inside the bell or surrounding the arms. Nothing else is currently known about the life cycle and biology of *A. shawi*.

*Anomalorhiza shawi* was encountered in the Hoi Ha Wan Marine Park, a secluded bay in the north-eastern waters of Hong Kong. This area is associated with important coral communities, hosting a large biodiversity of flora and fauna, and also includes ecologically sensitive mangroves, which provide habitat to juvenile fish and invertebrate populations. The sighting of *A. shawi* within this area could indicate that the species may not be oceanic, and may be associated with juvenile fish and invertebrates as a protection from predators, which is supported by the conclusions drawn by Chuan et al. (2020).

Using community-based platforms for scientific research is extremely helpful and can be used concurrently to academic research databases and tools. Online community science platforms have the advantage of helping discover new sightings of species (Skejo et al. 2016; Winterton et al. 2020), as well as being freely accessible for all to contribute to scientific research. They are also constantly updated. As of 2020, iNaturalist has more than 51 million biological observations from more than 1.3 million observers. The value of these observations obtained freely from the public can be extracted to assess population distributions and species diversity in specific areas (Michonneau and Paulay 2015; Hochmair et al. 2020), and as an educational tool for schools and

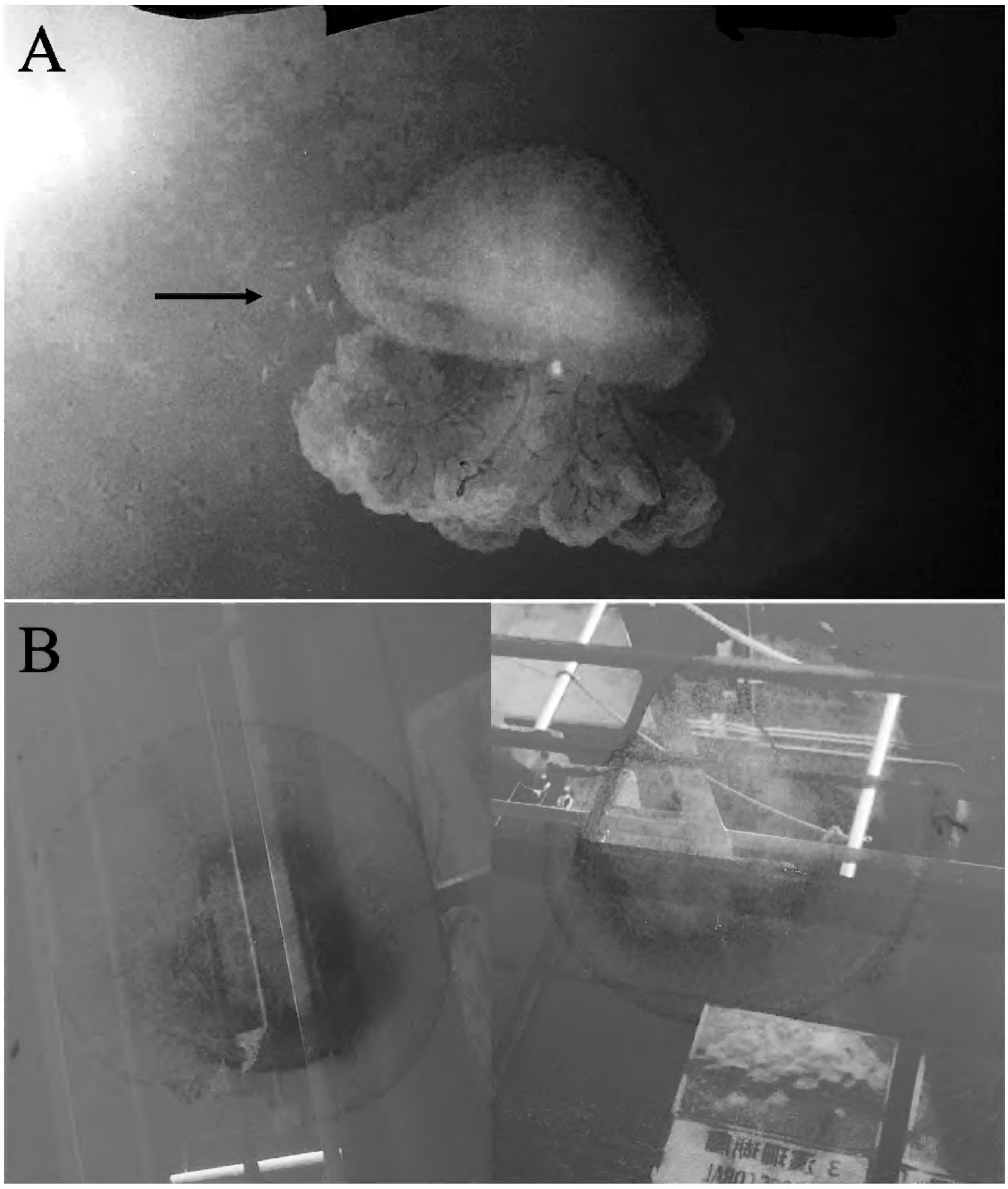


**Figure 3.** *Anomalorhiza shawi* in the Hoi Ha Wan Marine Park, Hong Kong. The images were taken through glass aboard a glass-bottomed boat. **A.** Side view with small fishes indicated by the arrow. **B.** Dorsal view.

the general public (Unger et al. 2020). The observation of *A. shawi* in Hong Kong waters has also contributed to the Hong Kong Jellyfish Project, a new iNaturalist project which aims to further enhance the knowledge of jellyfish species present in Hong Kong and forms part of an expanding database of locally found species.

Our study highlights the importance of community science and its utility in confirming species in areas where they were previously unknown. This new observation of *A. shawi* provides important baseline data in determining the spatial range of this species and adds to the known marine species present in Hong Kong waters and its marine protected areas. As the life history, ecology, and biology of this species are still unknown, more sightings can be made to hopefully gain a better understanding of this elusive species.

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## Authors' Contributions

PMCR wrote the manuscript. CHAC took and provided the photographs of the specimen.

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